UUI: Reusable Spatial Data Services in Unified User Interface at NASA GES DISC

http://disc.gsfc.nasa.gov/uui/

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GES DISC is a data center that provides access to large-scale archives of earth science data. Also applications and services built on top of the data.
Going forward

Unified User Interface

Context (space, time, data, keywords...)

Information | Visualization | Subset | Search

Data

GUI

Data Services

Data Archive
Unified User Interface (UUI)

Search/find/navigate ANY DATA RESOURCE, while retaining CONTEXT for cross-resource SEAMLESS NAVIGATION:

- Data granules
- Data subsets (in bulk)
- Data visualization in/from Giovanni
- Data Documentation
- Dataset Landing Pages
Data access and available services

Select from available subsetting options below then Get Data:

- **Refine Date Range:** 2007-01-01 to 2008-01-02
- **Time of Day:** Mean of daily file
- **Spatial Subset:** -180, -90, 180, 90
- **Grid:** Bilinear Interpolation on geos1x1 grid
- **Remapping Type:**
  - Bilinear Interpolation
  - geos1x1
- **Variables:** 2 variable(s) selected
- **Dimensions:** Get all dimensions
- **File Format:** NetCDF4

Download links list

Readme document:
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070101.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070102.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070103.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070104.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070105.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070106.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070107.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070108.SUB.nc
- MERRA300.prod.assim.inst3_3d_asm_Cp.20070109.SUB.nc
Services

• Build around a notion of web services
  • Small, self-contained, web-accessible building blocks
  • Can be reused and chained to build more complex services

• Each service provides a well-defined specification
  • Allows for an easy verification, integration, maintenance
  • JSON WSP as a main vehicle, enhanced based on …
  • OpenSearch / GEO and OGC WPS recommendations

• Legacy services wrapped in JSON WSP
Architecture

AngularJS

Node.js

Mongo DB

Content View

Web Server, Built-in services

Web Page

User Actions

JSON WSP request

JSON WSP response

Query

JS Objects

Legacy Service wrappers

OPeNDAP
SSW
Giovanni

CMR, Legacy metadata

Metadata

Database
### Specification

```json
{
  "type": "jsonwsp\description",
  "version": "1.0",
  "servicename": "Keywords service",
  "url": "http://disc.gsfc.nasa.gov/uui/service/keywords/jsonwsp",
  "methods": {
    "getSynonyms": {
      "doc_lines": ["Returns synonyms"],
      "params": {
        "keyword": {
          "doc_lines": ["a keyword"],
          "type": "string",
          "optional": false
        }
      },
      "ret_info": {
        "type": ["string"]
      }
    }
  }
}
```

### Request (POST)

```json
{
  "type": "jsonwsp\request",
  "version": "1.0",
  "methodname": "getSynonyms",
  "args": {
    "keyword": "AOD"
  }
}
```

### Response

```json
{
  "type": "jsonwsp\response",
  "version": "1.0",
  "servicename": "Keywords service",
  "method": "getSynonyms",
  "result": ["AOT", "Aerosol Optical Depth"]
}
```

- Request params named based on OpenSearch/GEO
  - start, end, box, etc
- Response is formatted based on OpenSearch as well
  - totalResults, startIndex, items etc.
Service interaction – OGC WPS

Synchronous Job

Asynchronous Job

Source: OGC® WPS 2.0 Interface Standard
Service composition and reuse

• Services are simple POST calls with parameters in => results out
• Easy to wrap as a function in many languages supporting JSON (JavaScript, Python, Perl, etc.)
• Wrapper function can be used as a building block to construct complex services
  • ... Search for data
  • Then Subset the data
  • Then Process the data
  • Then Plot the data ...
Reuse by External Clients

- Easy for external clients to consume services and build composite applications
- Don’t need to know internal protocols and APIs of GES DISC applications
- Implement a single API - use with any service

Suggested Datasets

<table>
<thead>
<tr>
<th>Score</th>
<th>Short Name</th>
<th>Version</th>
<th>Title</th>
<th>Covers event</th>
<th>In Giovanni</th>
<th>2D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.13</td>
<td>TRMM_3B4</td>
<td>2</td>
<td>TRMM (TMPA) RAINFALL ESTIMATE L3 3 HOUR 0.25 DEGREE X 0.25 DEGREE V7 (TRMM_3B4) AT GES DISC</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Suggested Variables

<table>
<thead>
<tr>
<th>Score</th>
<th>SDS</th>
<th>Title</th>
<th>2D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.39</td>
<td>precipitation</td>
<td>Precipitation</td>
<td>✔</td>
</tr>
</tbody>
</table>

Suggested Plot Services

<table>
<thead>
<tr>
<th>Score</th>
<th>Plot Service</th>
<th>Feature</th>
<th>Feature Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.36</td>
<td>Accumulation of measurement over time at each grid point</td>
<td>WindFields</td>
<td>Open in Giovanni</td>
</tr>
<tr>
<td>1.36</td>
<td>Longitude-averaged Hovmoller, plotted over the selected time and latitude ranges</td>
<td>Hurricane Eye</td>
<td>Open in Giovanni</td>
</tr>
</tbody>
</table>
Challenges and limitations

- Lack of means for automatic discovery and reuse in JSON WSP
  - Lacks semantic information (some relief in OpenSearch GEO)
  - Can’t specify acceptable required/optional combinations for args
  - Needs better customization

- Rigid communication protocol in OGC WPS
  - Does not specify retrieval of intermediate results
  - Can not process / display results of long-running jobs until complete (no piping)
Summary

• New interface provides a simple and modern user experience, replacing and integrating with a number of legacy data services and applications at GES DISC

• Service-based implementation takes advantage of modern technologies and standards
  • High maintainability, evolvability, and forward compatibility

• Services are easy to reuse by partner applications
  • Search, Subset, Regrid, Format
  • Visualization (coming soon)